

**CLAIMS**

What we claim is:

- 1 1. A method for converting natural gas to an olefin,. comprising:
  - 2 a) providing a stream of natural gas;
  - 3 b) separating the natural gas stream into a feed stream and a burn stream;
  - 4 c) conveying the feed stream and burn stream to a furnace wherein the burn stream
  - 5 is burned and wherein the feed stream is heated to form hydrogen and reactive products
  - 6 comprising an acetylene portion;
  - 7 d) quenching the reactive products and hydrogen; and
  - 8 e) conveying the reactive products to a catalytic reactor and providing hydrogen and
  - 9 a catalyst in the reactor such that the reactive products are converted to the olefin.
- 1 2. The method of claim 1 wherein the pressure of the natural gas stream is between about 1
- 2 bar and about 20 bars.
- 1 3. The method of claim 1 wherein in step b) the feed stream is heated to a temperature in the
- 2 range from about 1000 K to about 1800 K.
- 1 4. The method of claim 3 wherein the feed stream is maintained at a temperature of at least
- 2 1000 K for less than 100 milliseconds.
- 1 5. The method of claim 1 wherein the catalyst in the catalytic reactor is selected from the
- 2 group of catalysts consisting of nickel-boride, metallic paladium, a bimetallic catalyst, and
- 3 palladium with a group 1b metal.

1 6. The method of claim 1 wherein the temperature in the catalytic reactor is in the range  
2 from about 300 K to about 1000 K.

1 7. The method of claim 1 wherein the olefin is ethylene.

1 8. A method for converting natural gas to an olefin, comprising:

2 a) providing a stream of natural gas;

3 b) conveying the natural gas to a reactor and heating the natural gas using electrical  
4 power, wherein the natural gas is heated to form hydrogen and reactive products comprising an  
5 acetylene portion;

6 c) quenching the reactive products and hydrogen;

7 d) conveying the reactive products and hydrogen to a catalytic reactor; and

8 e) providing hydrogen and a catalyst in the reactor such that the reactive products  
9 are converted to the olefin.

1 9. The method of claim 8 wherein in step b) the electrical power employs an electrical arc,  
2 resistance heating a plasma reactor, a fuel cell or a combined cycle gas turbine drive electrical  
3 generator.

1 10. The method of claim 8 wherein the pressure of the natural gas stream is between about 1  
2 bar and about 20 bars.

1 11. The method of claim 8 wherein in step b) the feed stream is heated to a temperature in the  
2 range from about 1000 K to about 1800 K.

1 12. The method of claim 8 wherein the feed stream is maintained at a temperature of at least  
2 1000 K for less than 100 milliseconds.

1 13. The method of claim 8 wherein the catalyst in the catalytic reactor is selected from the  
2 group of catalysts consisting of nickel-boride, metallic palladium, a bimetallic catalyst, and  
3 palladium with a group 1b metal.

1 14. The method of claim 1 wherein the temperature in the catalytic reactor is in the range  
2 from about 300 K to about 1000 K.

1 15. A method for converting natural gas to an olefin,. comprising:

2 a) providing a stream of natural gas;

3 b) conveying the natural gas through a furnace wherein hydrogen is burned and  
4 wherein the natural gas is heated to form hydrogen and reactive products comprising an  
5 acetylene portion;

6 c) quenching the reactive products and hydrogen; and

7 d) conveying the reactive products to a catalytic reactor and providing hydrogen and  
8 a catalyst in the reactor such that the reactive products are converted to the olefin.

1 16. The method of claim 15 wherein the pressure of the natural gas stream is between about 1  
2 bar and about 20 bars.

1 17. The method of claim 15 wherein in step b) the feed stream is heated to a temperature in  
2 the range from about 1000 K to about 1800 K.

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2 18. The method of claim 15 wherein the feed stream is maintained at a temperature of at least  
3 1000 K for less than 100 milliseconds.

1 19. The method of claim 15 wherein the catalyst in the catalytic reactor is selected from the  
2 group of catalysts consisting of nickel-boride, metallic paladium, a bimetallic catalyst, and  
3 palladium with a group 1b metal.

1 20. The method of claim 15 wherein the temperature in the catalytic reactor is in the range  
2 from about 300 K to about 1000 K.